REMARKS

Claims 1-31 are currently pending in the subject application, and are presently under consideration. Claims 21-26 are allowed. Claims 1-7, 9-20, 27-31 stand rejected. Claim 8 has been indicated as allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Claims 1, 2, 4, 8, 9, 13, 14, 15, 16 and 18 have been amended and claims 27-31 have been cancelled. Favorable reconsideration of the application is requested in view of the amendments and comments herein.

I. Interview Summary

Applicant's representative thanks the Examiner for the courtesy extended during a telephone interview on June 2, 2008. During the Interview, U.S. Patent No. 5,028,924 to Thompson (hereinafter, "Thompson") was discussed generally as well as applied relative to claims 1, 13 and 14. A general agreement was reached regarding differences between the concepts being claimed and Thompson. Proposed amendments for claims 1 and 13 were submitted to the Examiner, which the Examiner indicated in a voice mail message should overcome Thompson, although additional searching may be required. This response has been prepared based on the Interview with the Examiner and the general agreements reached concerning differences Thompson and claims 1 and 13 as well as claims already considered to contain allowable subject matter.

II. Rejection of Claims 1-4, 9-15, 18-20 and 29-31 under 35 U.S.C. 102(e)

Claims 1-4, 9-15, 18-20 and 29-31 have been rejected under 35 U.S.C. 102 as being anticipated by U.S. Patent No. 5,028,924 to Thompson (hereinafter, "Thompson"). Claim 1 has been amended to recite memory that stores the digital error model and that the digital error model is parameterized by an error coefficient vector that includes a plurality of error coefficients, at least a portion of the plurality of error coefficients are adaptively adjusted, as recited in claim 1. Support for these amendments to claim 1 can be found, for example, in original claims 8 and 18 as well as at page 5, line 31 and FIG. 2 of the above-identified application.

As discussed with the Examiner during the telephone interview and as agreed in response to the proposed amendment to claim 1, Thompson does not disclose, explicitly or inherently, the compensation system of claim 1, including memory that stores a digital error model that is parameterized as an error coefficient vector that includes a plurality of error coefficients. In sharp contrast, Thompson teaches a counter that is set to a value to provide a digital correction signal to compensate for gain mismatches between the sigma delta modulation stages (Thompson, at col. 3, lines 6 – 9). Consequently, Thompson also fails to teach an emulated error signal that emulates error characteristics associated with a DAC, as recited in amended claim 1. Instead, Thompson teaches a digital correction signal to compensate for gain mismatches among sigma delta modulation stages (Thompson, col. 3, lines 6 – 9).

For these reasons, Thompson does not anticipate amended claim 1. Withdrawal of the rejection of claim 1, as well as claim 3 which depends therefrom, is respectfully requested.

Claims 2 and 4 have also been amended to recite that the error model is parameterized by an error coefficient vector that includes a plurality of error coefficients (similar to claim 1). Since Thompson fails to teach or suggest such an error model, as discussed above with respect to amended claim 1, amended claim 2 and its dependent claim 3 as well as amended claim 4 are patentable. Withdrawal of the rejection of claims 2 through 4 is respectfully requested.

Claim 9 has been amended to recite additional features of the calibration system similar to as recited in allowed claim 21 and as set forth in original claim 11. In contrast to claim 9, Thompson fails to suggest that any type of signal that might correspond to the calibration signal of amended claim 9, which signal is substantially free of in-band frequencies. Instead, Thompson describes calibration with a signal that appears to be an in-band signal (See Thompson, at col. 10, lines 35-64). It also does not appear that any signal (i.e., the preload output to the counter 100) disclosed in Thompson, which might be considered a calibration signal, is provided to a conversion system in Thompson. As a result of these differences, the approach in Thompson does not include a calibration system that is configured to operate in the manner recited in amended claim 9, such that claim 9 is not anticipated by Thompson. Claims 10, 11 and 12 depend from amended claim 9 and thus are patentable over Thompson for at least the same reasons. Claim 11 has been amended to delete subject matter that has been incorporated into claim 9 from which it depends.

Claim 13 has been amended as set out in the proposed claim amendment based on the telephone interview with the Examiner. Support for the amendments can be found, for example, in the present application in FIGS. 1 and 2 and at page 5, lines 17+ and page 8, lines 10+. As mentioned above, the Examiner left a voice mail message for the undersigned indicating that the proposed amendment to claim 13 appeared to overcome the rejection in view of Thompson. As discussed with the Examiner during the telephone interview, fails to teach a digital error model that provides an emulated error signal to a modulator that is part of conversion system, as recited in claim 13. Instead, Thompson teaches a compensation generator and a counter that provide a digital correction signal to a digital integrator (Thompson, col. 4, lines 48 -49 and FIG. 1).

For these reasons, Thompson does not anticipate amended claim 13. Withdrawal of the rejection of claim 13, as well as claims 14 and 15 which depends therefrom, is respectfully requested.

Claim 14 has been amended to be consistent with the amendments to claim 13 from which claim 14 depends. Claim 15 has also been amended to include substantially the same amendments as were made to claim 13. Accordingly, claims 14 and 15 are not anticipated by Thompson for at least the same reasons discussed above with respect to claim 13.

Claim 18 has been amended in a manner similar to claims 1 and 2; namely, the digital error model is recited as comprising an error vector that includes error coefficients. Thus claim 18 as well as claims 19 and 20 that depend from claim 18 are patentable for reasons similar to those discussed with respect to claims 1 and 2.

Claims 27-31 have been canceled such that the rejection of these claims is moot.

III. Objection of Claim 8

Claim 8 has been objected to as being dependent on rejected claim 5. Claim 8 has been indicated to be allowable if rewritten in independent form. Claim 8 has been rewritten in independent form as suggested in the Office Action. Therefore, allowance of amended claim 8 is respectfully requested.

IV. Rejection of Claims 5, 6, 7 under 35 U.S.C. 103(a)

Claims 5, 6, 7 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Thompson in view of U.S. Patent Publication No. 2004/0190649 to Endres, et al. (hereinafter, "Endres"). Applicant traverses this rejection for the following reasons.

The Examiner asserts that Endres discloses a splitter to divide an input signal into plural intermediate signals (page 12, section 0179) and a multi-input signal output system to combine the signals to produce an error term (page 12, section 0179). After closely analyzing the contents of Endres, the Applicant fails to see the relevance of this reference to the subject matter that is recited in claims 5-7, especially if the teachings of Endres are applied to Thompson in the manner suggested in the Office Action.

Briefly stated, claim 5 recites that the error model comprises a splitter to divide the input signal into plural intermediate signals, and a multi-input single output system that employs the parameters, error coefficients, of the digital error model to combine the intermediate signals for providing the emulated error signal. In non-analogous art, Endres teaches that some error term (LMS error term) is split into two plural intermediate signals (Endres, page 12, para. [0179]). However, the approach employed in Endres is substantially different from what is recited in claim 5 of the present application. The approach in Endres can be summarized as follows: the absolute value of each signal is taken; thereafter each value is individually compared (in separate comparators) against some predetermined threshold value T_e, which is adjusted until the one-bit output of each comparator is 'true' (Endres, page 12, para. [0179]). The output of each comparator is provided as an input to an AND gate, which outputs 'true' only when both terms are less then T_e. (Endres, page 12, para. [0179]). That is, the approach in Endres does not combine the intermediate signals for providing an emulated error signal. Instead, the system of Endres outputs the single-bit result (i.e. a 'true' or 'false') as a result of each of the comparisons (Endres, page 12, para. [0179], and Fig. 9) and it is the resulting single bit outputs that are ANDed together to provide another single bit signal. Therefore, Endres does not teach the combination of a splitter and a multi-input single output system that employs the parameters of the digital error model to combine intermediate signals for providing the emulated error signal.

Moreover, there is no proper motivation to implement the system of Endres into Thompson, as suggested, since the system of Endres would likely render the system of

Thompson inoperative. For instance, there is no evidence to support that the system of Endres would be able to provide an appropriate correction signal to the comb filter of Thompson.

Since neither Endres nor Thompson, individually or in combination, make claim 5 obvious, withdrawal of the rejection of claim 5, as well as claims 6 and 7 which depend therefrom, is respectfully requested.

Additionally, claim 6 recites a weighting component that applies weighting to the intermediate signals based on the parameter of the digital error model in addition to a system to combine the weighted signals. In contrast, Endres does not teach or suggest a weighting component that is applied to the intermediate signals. Instead, as discussed above with respect to claim 5, Endres teaches that the absolute values of the un-weighted, intermediate signals are compared against some threshold value T_e (Endres, page 12, section 0179). Therefore, because Endres does not teach a weighting component that is applied to the intermediate signals, withdrawal of the rejection of claim 6 as well as claims 7 which depend therefrom, is respectfully requested.

Claim 7 also recites that each of the parameters of the digital error model is applied to a respective one of the intermediate signals to provide the weighted intermediate signals. In sharp contrast, the approach in Endres, the threshold value T_e (which is not a parameter of an error model) is not applied as weight the intermediate signals. Instead, the intermediate signals are compared to the threshold value (page 12, section 0179, and figure 9) resulting in a binary output, which does not correspond to weighted intermediate signal as recited in claim 7.

For these reasons, reconsideration and allowance of claims 5-7 are respectfully requested.

IV. Rejection of Claims 16 and 17 under 35 U.S.C. 103(a)

Claims 16 and 17 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Thompson in view of U.S. Patent No. 5,061,925 to Sooch et al (hereinafter, "Sooch"). Applicant traverses this rejection for the following reasons.

The Office Action states that Thompson does not disclose an analog filter to remove out of band frequencies and quantize signal (assuming the Office Action meant quantization noise) from a corresponding analog output to provide a corresponding analog output filtered signal (Office Action, at page 11). The Office Action then seeks to rely on Sooch for its teaching of an

analog filter that is used to keep images and quantization noise outside the passband small and, where a delta-sigma modulator is used, to reduce quantization noise (Sooch, col. 4, lines 41-45). Based on this teaching from Sooch and Thompson, the Office Action concludes that it would have been obvious at the time of the invention to use an analog filter to remove out of band frequencies from the converted signal from the DAC (Office Action at top of page 12).

Applicant disagrees with this conclusion. The first significant different that militates against combining such teaching of Sooch with Thompson is the fact that the Thompson relates to an analog-to-digital conversion system that employs a sigma-delta converter, as opposed to a digital-to-analog system in Sooch. Significantly, the system in Thompson already teaches a comb filter 15 employed at the output of the analog-to-digital converter 12 for reducing the quantization error (Thompson, Abstract and col. 3, lines 31-45). However, because the output of the conversion system in Thompson is a digital signal, the digital filter 15 is used to achieve the desired reduction in quantization error. Thus, a filter having substantially the same function as the filter of Sooch suggested in the Office Action already exists in Thompson at the output of the analog-to-digital (NOT digital-to-analog) sigma-delta modulator 12. Since a filter is already provided for performing the function for which the Examiner is seeking to rely on Sooch, there does not appear to sufficient motivation to combine the references and thereby support the conclusion of obvious based on the teachings of Sooch and Thompson.

Moreover, in view of the existence of the digital filter 15 at the output of the ADC, it is presumed that the Office Action contends that the proffered combination of Thompson and Sooch is to employ an analog filter, as taught in Sooch, at the output of the internal DAC in the feedback loop of the first two stages of the sigma-delta modulator 12 taught by Thompson (Thompson, FIG. 2 and at col. 4, line 60, through col. 5, line 20). However, such a contention results in a modification to Thompson that fails to meet the combination of structural and functional features recited in claim 16. In particular, claim 16 recites an analog filter that provides a filtered analog signal and an analog-to-digital (A/D) converter that converts the filtered analog signal into a corresponding digital representation of the filtered signal. Significantly, claim 16 recites that the calibration system calibrates the parameters of the digital error model as a function of the digital representation of the filtered signal (filtering after the analog-to-digital converter), which clearly would not be case if Thompson is modified to include

an analog filter at the output of the DAC 58, as suggested in the Office Action. In contrast, if such an analog filter would be placed at the output of the DAC 58, the filtered signal from the DAC 58 in Thompson is the subtracted from the analog input signal that is provided at input represented by reference number 13 of the ADC 12 (Thompson, col. 4, lines 60 – 68; col. 5, lines 1 – 11). Accordingly, there is no way the proffered combination would teach or suggest calibration to occur in the manner recited in claim 6 (namely, calibration of parameters of the digital error model as a function of the digital representation of the filtered signal) since claim differentiation requires that the claimed input signal that is quantized is different from the digital representation of the filtered signal. That is, in Thompson the purported filtered digital signal is internal within the ADC 12 such that it cannot be used for the calibration function taught by Thompson.

Additionally, if an analog filter were placed at the output of the DAC 58, as suggested in the Office Action, there is no evidence to support that the multi-stage sigma delta analog-to-digital 12 would still operate for its intended purpose.

For these reasons, there is not sufficient evidence to support that the legal conclusion that the combination of features in claim 16 would be obvious by combining the teachings of Sooch with Thompson, as suggested in the Office Action.

Claim 17 recites the DAC of the compensation comprises a binary weighted, multi-bit DAC that includes at least two capacitors, and that the parameters of the digital error model characterize the mismatch errors in the at least two capacitors thereof. In contrast, the Office Action relies on Sooch for a teaching of a switched capacitor filter 106 comprised of four capacitor stages 110, 112, 114 and 116, the first of which stage functions as the one bit DAC (Sooch, col., 6, lines 46-53). However, Sooch does not teach a multi-bit DAC, as recited in claim 17. Consequently, there is no evidence of record to support the position that an error model of the type of claim 7 (with parameters that characterize errors in the capacitors of DAC) would be realized from the combined teachings of Thompson and Sooch. Furthermore, applicant submits that multi-bit DAC would not be useful to mitigate error in Thompson because the DAC in Thompson forms a single-bit feedback loop (Thompson, col. 5, lines 1 – 5). Because Thompson's compensation system does not include a digital error model to model and compensate for the DAC errors corresponding to mismatch errors in the capacitors of the DAC,

there is not sufficient motivation or any suggestion to modify Thompson with a DAC according to what is recited in claim 17. Since the Office Action has not produced evidence sufficient to support a legal conclusion of obviousness for claim 17, withdrawal of the rejection of claim 17 is respectfully requested.

V. CONCLUSION

In view of the foregoing remarks, Applicant respectfully submits that the present application is in condition for allowance. Applicant respectfully requests reconsideration of this application and that the application be passed to issue.

Should the Examiner have any questions concerning this paper, the Examiner is invited and encouraged to contact Applicant's undersigned attorney at (216) 621-2234, Ext. 106.

Fees for payment of a two-month extension of time are being charged via a separate transmittal to Deposit Account No. 20-0668 of Texas Instruments Incorporated. No additional fees should be due for this response due to the cancellation of claims 27-31. In the event any fees are due in connection with the filing of this document, the Commissioner is authorized to charge those fees to Deposit Account No. 20-0668 of Texas Instruments Incorporated.

I hereby certify that this correspondence is being transmitted to the U.S. Patent and Trademark Office via electronic filing on June 14, 2008.

Respectfully submitted,

/Gary J Pitzer/

Gary J. Pitzer
Registration No. 39,334
Attorney for Applicant(s)

CUSTOMER NO.: 23494

TEXAS INSTRUMENTS INCORPORATED
P.O. Box 655474, M/S 3999
Dallas, TX 75265
(972) 917-5633